U.S. Amy Centerfor Health Promotion and Preventive Medicine

Just the Facts

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Hazard Alert for Laser Welders, Cutters, Heat Treaters, and Punch Presses

- **High-power lasers**
- **Serious skin and eye damage**
- **Control measures**

Purpose

The use of high-power lasers for industrial cutting and welding is becoming widespread in the U.S. Army industrial community. Normal industrial safety practices may not be adequate for these devices. Users may need to identify additional potential hazards and develop appropriate precautions.

Devices of Concern

Devices of concern include: laser welders, laser cutters, laser heat treaters, and laser punch presses.

Potential Optical Radiation Hazards

The potential optical radiation health hazards include: serious eye and skin damage from direct exposure to the beam, laser reflections, secondary emissions from the work-piece incandescence, and plasma.

All of these hazards can exceed personnel viewing exposure standards. Most industrial lasers are far infrared (IR) carbon-dioxide lasers and near-infrared (NIR) neodymium-YAG lasers. The IR lasers pose hazards to the cornea of the eye and to the skin; whereas, the NIR lasers pose a potential retinal burn hazard and thermal skin bum hazard. Secondary emissions viewed through filtered view-ports do not pose a potential for retinal injury within the normal blink response time for the eye. Potentially hazardous actinic ultraviolet emissions are absorbed by the view-port window.

Enclosed Industrial Laser Systems

Many industrial laser systems are "enclosed" and consist of three parts:

- The actual laser component.
- A light pipe which carries the laser beam.
- An interlocked work enclosure where the beam acts on a work-piece.

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Each component encloses the beam so that personnel cannot gain ready access. Such systems are classified from a hazard standpoint by the American National Standard Institute (ANSI) 2136.1 (Reference 1) as a Class 1 safe laser system. Personnel are not at any significant risk to primary beam exposure from a Class 1 laser system except during a malfunction, service, or beam alignment. Service or beam alignment procedures require development of safety standing operating procedures (SOPs). Only trained personnel should perform these SOPs.

ANSI Class 4 Unenclosed Industrial Laser Systems

Most laser cutters and punch presses often are not entirely enclosed. A small gap may exist (e.g., where sheet metal can be inserted). Such unenclosed laser systems are normally classified technically from a hazard stand-point by ANSI as Class 4 or high-power laser system. The ANSI recommends locating Class 4 lasers in a separate closed room. Experience by the Laser/Optical Radiation Program (LORP), U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), indicates that potentially harmful laser emissions do not usually escape at the gap in a laser press. Additional measurements are needed to confirm this for a variety of laser wavelengths and work situations.

Associated Hazards

Other associated hazards are addressed in draft ANSI B1 1.21 (Reference 2). Some ancillary hazards are high voltage, toxic materials, and vapors. Ventilation for toxic materials could be necessary in the work area to control airborne contaminants as prescribed by an industrial hygienist. Also, high power lasers are often guided with a coaxial, low-power visible laser for alignment. Most alignment lasers do not pose a significant health hazard.

Control Measures

Industrial laser systems sold in the U.S. are required to comply with the safety design features of the Federal standard for laser products contained in 2 1 CFR 1040 (Reference 3). While these standards assume safety for Class 1 products, the *user* must provide safe operation for Class 4 laser systems. Users should periodically inspect all laser system components (e.g., mirrors, view-port windows, light pipe, etc.) for signs of laser beam damage and remove a damaged system from service until it is repaired. Scratched or damaged view-port windows should only be replaced with appropriate materials such as polycarbonate shielding. Personnel required to view laser welding operations through unfiltered view-port windows may need to wear electric arc welding eye protection which affords a comfortable viewing brightness of any secondary emissions such as plasma.

Conclusions

While industrial lasers are normally considered safe for use, personnel must remain alert to potentially hazardous conditions and take appropriate action. USACHPPM has the technical expertise to evaluate the potential optical radiation health hazards from industrial laser systems. Requests for evaluations should be referred to LORP, USACHPPM.

References

1. ANSI Z ***136.1 - 1993, American*** *National* ***Standardfor the Safe*** Use of ***Lasers,*** Orlando, Laser Institute of America.

2. ANSI B1 1.21 **-** 1995, ***Machine Tools Using Lasers For Processing Materials - Safety Requirements for Construction, Care, and Use. New*** York, ANSI.

3. 2 1 Code of Federal Regulations, Part ***1040.10,*** *Performance* ***Standards for Light-Emitting Products,*** 1996.